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TESTIMONY OF

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BEFORE THE

SUBCOMMITTEE ON TECHNOLOGY AND INNOVATION

OF THE

HOUSE COMMITTEE ON SCIENCE AND TECHNOLOGY

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**Review of the Department of Defense (DoD)
Small Business Innovation Research (SBIR) and Small Business Technology
Transfer (STTR) Programs: Statement for the Record**

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Chairman Wu, Congressman Gingrey and Members of the Subcommittee on Technology and Innovation, House Committee on Science and Technology:

Thank you for the opportunity to submit a written statement about the Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) programs as you consider reauthorization of the SBIR program in the year of its 25th anniversary. I welcome this opportunity because these programs have become important tools for the Department of Defense (DoD) to seed innovation in our industrial base, and, in so doing, develop firms to supply leading-edge technologies to meet warfighter needs today and in the future.

It is the fundamental mission of the Department of Defense to fight and win our nation's wars. In a time of war, the challenges are myriad, as we must sustain critical operations around the world while also preparing for the future—being ready to face the threats of tomorrow. Tasks of particular importance are the supply of materiel to the warfighter to defeat identified threats, and the exploration and development of technologies to enable new or lower cost capabilities. To these ends, the Department has established key goals to ensure we are investing in the right technologies, and cultivating

an industrial base capable of meeting our strategic needs. The SBIR and STTR programs play roles in achieving both of these goals. Specifically, consistent with statute, this means to seed technologies through small firms which may eventually provide a materiel solution to our nation's warfighting soldiers, sailors, marines and airmen, either directly as a product or service, or as part of a larger weapon or support system.

It is our obligation as public officials to ensure that we are using taxpayer dollars as productively and efficiently as possible for their intended purpose. In that vein, today I will address the questions presented to me in your invitation and will also highlight actions the Department has undertaken to improve our Program. We at the Department are always ready to work with the Congressional oversight committees, other participating federal agencies and the Small Business Administration (SBA) to ensure that the SBIR and STTR programs are as effective as they can possibly be.

Program Overview

The DoD SBIR Program encompasses twelve constituent Military Department and Defense Agency programs. The participating elements of DoD, hereafter in this testimony referred to as "Components," include, in order of largest to smallest budget in fiscal year (FY) 2007 the: Air Force, Navy, Army, Missile Defense Agency (MDA), Defense Advanced Research Projects Agency (DARPA), Office of the Secretary of

Defense¹ (OSD), Joint Office of Chemical and Biological Defense (CBD), US Special Operations Command (SOCOM), Defense Threat Reduction Agency (DTRA), Defense Microelectronics Activity² (DMEA), Defense Logistics Agency (DLA) and National Geospatial-Intelligence Agency³ (NGA). The Department's SBIR budget is determined by a statutory 2.5 percent assessment of its extramural⁴ research, development, test and evaluation (RDT&E) budget. Each Component's portion of the overall program is managed to be responsive to its specific mission and corresponding technology development needs while also being consistent with overarching Department science and technology guidance.

In terms of budget, the Department's Program represents over 50 percent of the total federal SBIR budget, which exceeds two billion dollars. The DoD SBIR Program has experienced substantial growth in recent years, more than doubling in size from FY 1999 to FY 2005 to over one billion dollars, and it continued to grow through FY 2007 to over \$1.13 billion. This expansion is driven directly by growth in underlying RDT&E budget, as the set-aside percentage has remained constant over this period of time. In FY06, 883 topics attracted 13,253 Phase I proposals, a rate of 15 proposals per topic—about the average of the prior four years. The Department awarded 1,862 Phase I contracts and 1,172 Phase II contracts.

Which firms received these contract awards? The recipients are all types of

¹ The OSD Program includes funds drawn from the Defense Health Program (DHP) and is managed by the Office of the Deputy Under Secretary of Defense (Science & Technology) within the Office of the Director, Defense Research & Engineering.

² DMEA and DLA are new SBIR participants in FY07.

³ NGA is a voluntary participant in SBIR.

technology-focused firms from across the country. To a great extent, these are very small firms. In FY 2006, 68 percent of Phase I contracts were awarded to firms with fewer than 25 employees, while over 42 percent were awarded to firms with fewer than 10 employees. This shows that, to a great extent, the Department taps entrepreneurial firms. Entrepreneurial firms tend to offer the most ground-breaking, potentially disruptive innovation—the type that fundamentally changes how a capability is provided. Also importantly, the DoD SBIR Program is an entry point for firms new to the defense business—those seeking to develop a military customer base. In FY 2006, 21 percent of SBIR Phase I award winners were first-time SBIR award recipients. And among the rest of the firms receiving Phase I awards in FY 2006, 44 percent had previously been awarded four or fewer Phase II contracts. Based again on FY 2006 data, 22 percent of Phase I award winners were minority- or women-owned firms, or from Historically Underutilized Business (HUB) Zones, indicating that a significant portion of resources is utilizing this segment of the business base, consistent with one of the primary goals of the SBIR program. Since the inception of the SBIR program in 1983, the Department has awarded nearly \$11 billion to qualifying small firms through over 44,500 contracts.

Examining these statistics, it is clear that the DoD SBIR Program is a very large, resource intensive enterprise. The central challenge is to make the best possible small business technology investments for our warfighters with the resources the Congress provides us. That concludes a brief overview, focusing on the DoD SBIR Program. Let

⁴ Extramural is defined as the sum of the total RDT&E obligations minus amounts obligated for such activities by employees of the participating agency in or through Government-owned, Government-operated facilities.

me now move on to address the specific questions posed in the invitation letter with these overview remarks serving as background for the discussion.

Program Efficiency and Effectiveness

The SBIR and STTR programs, due to the sheer volume of topics, proposals, and awards demand efficiency in execution. In the time since the SBIR program was last authorized in 2000, the Department has provided over \$5 billion in extramural research and development funding to qualifying small businesses through over 17,000 Phase I and Phase II contracts. On average, the Department has consistently met the goals of awarding phase I contracts within four months of solicitation closing, and awarding phase II contracts within 6 months of the conclusion of the corresponding phase I contracts.

For administrative efficiency and to make it easier for small businesses to interact with the Department, all approved topics from participating components are packaged into one solicitation and pre-released to the public for a four-week period. During this period, interested firms may seek additional technical information from the technical points of contact, as necessary, to clarify the topics. The solicitation then opens for a four-week period during which proposals are received. Throughout the pre-release and solicitation periods, interested firms may ask questions about the topics of interest via the online SBIR/STTR Interactive Topic Information System (SITIS). After the solicitation closes, all proposals are reviewed by government scientific and technical personnel.

This process occurs three times per year for SBIR and once for the STTR program. SBIR Phase II proposals are submitted to the Department to meet deadlines

established by participating DoD components. Topic generation and review, as well as solicitation pre-release, release and proposal submission are entirely electronic, conducted through the DoD SBIR Worldwide Web site (www.dodsbir.net). These electronic systems have helped enable the DoD SBIR and STTR programs to accommodate an increase in the number of solicitations conducted and proposals received while meeting time-to-award goals.

The high watermark for SBIR/STTR's effect success or effectiveness in the Department is bringing leading-edge technology solutions to the warfighter by leveraging the unique, entrepreneurial power of small businesses. Of course, the dictionary definition of efficiency is the ratio of the useful output (effect) of a program to the total input. We've discussed the inputs, or costs, elsewhere in this statement. Let's spend a few moments on the outputs. Accurately quantifying the full impact of technology innovation is a challenge. We measure program output in the form of both documented success stories and commercialization data, using follow-on sales and investment as a proxy for value creation.

The Department collects commercialization data from firms on all Phase II contracts and asks firms to keep this data current. Updates are requested annually and when firms submit proposals. Both the strength and weakness of this data set is that it is self-reported by firms. The Department is thus reliant upon them to report accurate and timely figures. A drawback to this reporting process is that we do not capture commercialization accruing to firms that have "graduated" from the program, growing to be ineligible for future awards either through organic expansion or via acquisition.

Commercialization may be quite substantial, perhaps rendering our data a conservative estimate of program impact. Despite this limitation, Phase II investments of \$6.7 billion in fiscal years 1984-2004 have generated total reported commercialization of nearly \$13 billion in sales, additional R&D, and capital investment. Allowing 3-4 years after the completion of Phase II for commercialization to develop, about 65% of SBIR topics—statements of technology need—generate some recorded commercialization⁵, while nearly 30% of topics generate commercialization in excess typical investment levels.⁶ Considering these aggregate program output measures, the SBIR and STTR programs are stimulating the development and sales of innovation within the Department and the broader economy.

In addition to measuring financial outcomes, we track program success stories, which demonstrate in a more concrete way the value the SBIR and STTR programs bring to specific customers. Perhaps the most vivid example of such a success story is Small Arms Protective Inserts (SAPI) and Enhance Small Arms Protective Inserts (E-SAPI) plates, which protect warfighters in theaters of operation from assault rifle and other small arms fire. Based on work done under FY 2000 and FY 2003 Navy SBIR contracts for vehicle armor, and a significant amount of follow-on research and development, ArmorWorks, Inc. of Tempe, Arizona developed high technology body armor plates for the Interceptor Body Armor System using advanced ceramic materials. To date, the firm

⁵ Again defined as sales, further R&D or further investment.

⁶ Commercialization figures are drawn from the firm-reported DoD SBIR Commercialization Database and encompass phase I awards made 1990-2003. Topic commercialization rates are calculated as the mean of yearly averages over this period of time. Considering only DoD-derived sales or investment (via prime or subcontract), 42% of topics generated some commercialization while 13% generated commercialization in excess of the typical

has supplied hundreds of thousands of ceramic armor plates for use in personal (SAPI and E-SAPI), vehicular and aircraft applications, saving lives of U. S. warfighters every day.

A second excellent example of a success story is the Army SBIR-originated Cockpit Air Bag System, designed and manufactured by Simula, Inc of Phoenix, Arizona. Composed of air bags, gas generators, and a unique three-axis crash sensor, the system is designed to protect helicopter aircrew from potentially fatal impacts in the event of a crash. The Army, Navy, Air Force, and Federal Aviation Administration all participated in the joint development of this system, leveraging prior SBIR-funded work and leading to a 2001 production contract. Simula, Inc. has already fielded the system on hundreds of DoD aircraft.

A third example of a success story is the Phraselator, a hand-held speech translation device developed by Marine Acoustics, Inc. (MAI), a veteran-owned small business based in Middletown, Rhode Island, through an FY 2001 DARPA SBIR effort.⁷ Following the terrorist attack in September of 2001, just seven months into their Phase II contract, DARPA requested that MAI accelerate development of a prototype Phraselator. MAI proved quite capable, delivering 200 units in a matter of weeks to US military forces for use in Afghanistan during Operation Enduring Freedom. Over 5,000 Phraselators are now in use in Afghanistan, Iraq, and around the world, and they were used extensively in tsunami relief efforts. There is potentially a large commercial

investment amount. Typical investment is set at \$850,000, the combined value of Phase I and Phase II contracts based on statutory guidelines.

⁷ The Phraselator is now owned and marketed by Voxtec, Inc.

market for the devices, which are particularly helpful in law enforcement and medical applications where situational urgency may not allow time for an interpreter to arrive on the scene.

A final example highlights the ability of SBIR-funded technologies to save the Department money by providing capabilities at a lower cost. It also highlights how two military departments can work together to develop mutually beneficial technologies and then employ the technology rapidly to meet an emerging warfighter need. JENTEK Sensors, Inc of Waltham, Massachusetts developed a thin, conformable sensor system to perform inspections on difficult-to-access locations of military systems. Using the same Phase III contract, Navy Depots were purchasing the sensors to inspect P-3 propeller blades while the Air Force was adding additional funding to miniaturize the sensors for use in difficult-to-access areas. A serious problem emerged with weld joints on some compressor blades threatening planes to be grounded. The technology available at the time was to disassemble and X-ray each blade at a cost of \$200,000 and considerable down time. In response to a Wednesday phone call, Jentek quickly found a solution employing the Air Force modifications under development. On the following Monday, depot technicians were able to complete a plane inspection in an hour using the “meandering, wandering magnetometer” technology at a cost of less than \$20,000.

Contract Award Guidelines: Flexibility is Key

In FY 2006, the average DoD Phase I award was \$89,300 and the average Phase II was \$720,800. Approximately 30 percent of these awards were modified due to

participation in the Fast Track and Phase II Enhancement programs or to address technical or mission needs. Among this set of awards, the average contract award was about \$135,000 for Phase I and \$1.1M for Phase II.

Current contract award guidelines are \$100,000 for Phase I and \$750,000 for Phase II. These have been in place since 1992 for the SBIR program and have not been increased to reflect inflation's impact on the price of research and development. The Department would support any SBA effort to increase these statutory and regulatory guidelines.

The cost of technology development and prototyping is part dependent on the type of technology being developed—some technologies are more expensive than others. For example, manufacturing-related initiatives can run into the millions of dollars to effectively prototype and demonstrate. Additionally, test, evaluation and validation can be quite expensive for technologies destined for military use. Thus, regardless of the level of the award guidelines, technology cost variability and the often high cost of bringing technologies to a transition-ready maturity level militate for flexibility in program execution.⁸ Thus, the Department appreciates the flexibility to judiciously go beyond the proscribed guidelines when necessary to be responsive to technology transition opportunities and produce successful outcomes.

Small Business Participation: Competition Provides Program Vitality

⁸ As a general rule, a Technology Readiness Level (TRL) of at least 6 (meaning a prototype has been demonstrated on a relevant environment) is required for system development to begin.

By almost any measure, the interest and participation in the SBIR and STTR programs has been strong. Small business participation in the DoD SBIR & STTR programs has been very strong. In fiscal years 2003-2006, the Department received an average of about 15 proposals per SBIR topic and 11 proposals per STTR topic. Prior to that, between fiscal years 1998 and 2001, the average was under 11 proposals per SBIR topic and 9 proposals per STTR topic. The programs fund only the best proposals in Phase I and only the “best-of-the-best” go on to Phase II. Historical Phase I funding rates are 14% for SBIR and 20% for STTR, with Phase II conversion rates of just below 50% for both programs.⁹

Outreach activities are important to ensure that small businesses have the opportunity to learn about the programs. Outreach is primarily conducted through attending conferences planned for this purpose, and through making information available to the public, primarily via the internet. The Department and its components support as many conferences as time and resources allow. Strong support of two national conferences and several regional and state events is the norm. Additionally, information contained on the DoD and on DoD component web pages is quite significant, permitting interested firms to learn virtually anything they might want to know about the programs. To supplement, the Department staffs a toll-free helpdesk to answer questions firms have about the programs.

As discussed earlier, the SBIR and STTR programs are often gateways to the defense market space for firms, a way for firms to test the market and be tested as a

⁹ Looking at Phase I awards and associated Phase II follow-on awards from solicitations in fiscal years 1994-2003.

potential new supplier. In fiscal year 2006, around 20% of Phase I awardees were first time award recipients while 29% of phase II award recipients never received a phase II award before. These are important benchmarks. To maintain a vital, innovative supplier base, particularly for new technologies, it is imperative that the Department encourage new and non-traditional firms to get involved.

Financing and Commercialization

The Department employs several mechanisms to address the funding gaps in the phased award structure, increase private equity participation, provide commercialization assistance, and ultimately help increase small businesses' share of federal procurement and non-SBIR/STTR R&D. First, commercialization potential plays a central role in proposals and source selection. Two of three criteria address this issue:

- qualifications of the firm and team to perform the research and development and commercialize the results, and;
- the commercialization¹⁰ potential of the proposed solution.

Further, firms with four or more prior SBIR Phase II contracts are assigned a Commercialization Achievement Index (CAI) score, which is a measure of how well the firm has commercialized prior SBIR technology relative to peers with the same number

¹⁰ Commercialization refers to the process of developing marketable products or services and producing and delivering products or services for sale (whether by the originating party or by others), to government and/or non-government markets. Funds data reported as commercialization includes the receipt of money for the performance of follow-on R&D (as government-supplied Phase III funds or other sources) and the collection of funds from investors. A related term is SBIR Phase III, which refers specifically to work that derives from, extends, or logically concludes effort(s) performed under prior SBIR funding agreements, but is funded by sources other than the SBIR

of Phase II awards. Firms with a CAI in the lowest fifteen percentile—those with the worst record of commercialization—receive fewer points in source selection.

To address the funding gap between Phase I and Phase II, many DoD components employ a Phase I contract option to fund research and development while the Phase II proposal is evaluated for funding. When this approach is taken, it virtually always takes the Phase I award amount above the statutory and regulatory guideline, triggering a reporting requirement. The Fast Track program also offers gap funding to qualified proposals while also attracting external matching funds.

The Phase II Enhancement program (also known as Phase II Plus) offers program funding to match qualifying external funding, sometimes (but not always) from a non-SBIR/STTR DoD source such as a laboratory or system program office, to further develop, demonstrate, test, and validate the technology. The Department's analysis shows that both the Fast Track and Phase II Enhancement programs are associated with systematically higher levels of commercialization.

As with the Phase I contact option, Phase II Enhancements virtually always increase the Phase II award level beyond the statutory and regulatory guidelines, triggering a reporting requirement. Preliminary analysis shows there is more interest among the components in performing Phase II Enhancements than in Fast Track. This is probably because the matching funds are brought to bear later in the research and development cycle when technology transition issues are more likely to be defined, and

program. Phase III work is thus typically oriented toward commercializing SBIR research or technology. The terms are often used synonymously and interchangeably when describing outcomes beyond SBIR Phase II.

the potential of the technology is better understood.

Technical assistance programs offer federal agencies the opportunity to provide targeted aid to SBIR and STTR award recipients to increase their chances of success. Section 9(q) of the Small Business Act currently permits \$4,000 per Phase I award and \$4,000 per year per Phase II award to be used to provide such assistance. However, to make the authority more useful and effective, the Department recommends a couple of changes:

- increase to \$5,000 per Phase I award to reflect the economic impact of inflation; and,
- increase Phase II assistance to up to \$8,000 per year, and permit Federal agencies to provide the assistance directly or through the Phase II contract.

The suggested increase in the level of assistance for Phase II reflects a more realistic cost of providing meaningful assistance to firms that need to cultivate markets for their innovations while simultaneously developing their technologies and capacity to produce them.

Within the DoD program, few components currently provide direct commercialization assistance. The adjustments suggested above and in the section 824 of the Administration's proposed National Defense Authorization Act for Fiscal Year 2008 forwarded to the Congress on February 6, 2007 (NDAA for FY08), will make the technical assistance more attractive and probably increase the likelihood that DoD components and other Federal agencies will use the authority.

Administrative Costs

SBIR/STTR program administration is quite resource intensive. This is in large part due to the phased program structure and contract award guidelines, which result in thousands of individual contracts. Each contract requires associated Departmental overhead for topic development and review, pre-release and solicitation interaction with industry, technical evaluation and source selection, contracting, and technical oversight and coordination, among other activities. Preliminary estimates by the RAND Corporation put this overhead at or above 5% of program budget, varying by component.¹¹

The SBIR and STTR set-aside budgets are drawn from previously programmed, budgeted and appropriated funds for other programs, which when budgeted contained resources for administration of these funds. Thus, the SBIR and STTR budgets contain funds that were identified to support administrative activities. However, the set-aside budgets for SBIR or STTR may not be used to support program administration. Support funding thus must be drawn from other sources.

A legislative change proposed by section 823 of the NDAA for FY 2008 would allow up to 3% of the SBIR and STTR set-aside budgets to be used to fund administrative expenses. The most important activities requiring these resources are contracting, technical oversight, and program coordination with systems developers and end-users. Benefits derived from this change will ultimately manifest themselves in overall program

performance, such as through the aggregate rate and magnitude of commercialization achieved. Modification of the current discretionary technical assistance authority (15 U.S.C. 638(q)), as suggested above, would provide ample resources for this task, particularly when combined with resources made available through the Commercialization Pilot Program (CPP) authority (15 U.S.C. 638(y)). Lastly, I would caution against raising the program set-aside from the current 2.5% absent analytically solid determination that such a change would produce value in excess of the additional direct and opportunity costs it would impose.

Conclusion

To conclude, I would like to recognize the efforts of our DoD SBIR program managers and the civilian and uniformed technical representatives and contracting officers, as well as contractors that support them. These dedicated, professional individuals work hard, day in and day out, to ensure that our SBIR dollars are spent on the most promising and relevant technologies. They don't always see immediate results from their labors—that is the nature of early-stage research and development (R&D). However, when projects develop into useful military products, the fruits of their labor can be seen saving lives and contributing to a wide variety of missions in Iraq, Afghanistan, and elsewhere around the world. We need not look further than these places to see that the program can make a positive impact, and that is due directly to their efforts.

¹¹ Drawn from "Evaluation and Recommendations for Improvement of the Department of Defense Small Business Innovation Research (SBIR) Program." The study efforts are funded by the Office of Small Business Programs,

In summary, again I thank you Chairman Wu for the opportunity to testify on the SBIR and STTR programs. I hope my testimony has provided you with an understanding of how we run the program at the Department and will assist in you and your colleagues as you consider program reauthorization. I would be happy to answer any questions you and the Members of the Subcommittee may have.